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CHANGE THE WORLD FROM HERE

Relational Databases

Structured Query Language (SQL)

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Introduction

- **Structured Query Language (SQL)**
  - Often pronounced “sequel” or “S-Q-L”
  - Standard language for communicating with relational databases
- **Relational Databases Management System (RDBMS)**
  - MySql, PostgreSQL, SQL Server, Oracle, IBM DB2, MariaDB, SQLite

SQL Statements

- **Keywords**
  - Traditionally UPPERCASE (optional)
  - Includes operators (e.g. =, >, etc.)
- **Identifiers**
  - Traditionally lowercase
- **Constants**

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SQL Statements

```
SELECT name FROM teams WHERE id=9
```


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SQL Statements: Keywords

```
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SQL Statements: Identifiers

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SELECT name FROM teams WHERE id=9
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SQL Statements: Constants

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Data Definition Language (DDL)

- **Create/Manipulate Structure**
  - e.g. tables, databases, schemas, etc.
- **Major statements**
  - CREATE: Adds a new database object
  - ALTER: Modify an existing database object
  - DROP: Removes a database object

https://dev.mysql.com/doc/refman/8.0/en/sql-syntax-data-definition.html

Column Data Types

- **Numeric Data Types**
  - INTEGER, DECIMAL, FLOAT, etc.
- **Character Data Types**
  - CHAR, VARCHAR, BLOB, etc.
- **Temporal Data Types**
  - DATE, TIME, etc.

Numeric Data Types

Type	Bytes	Minimum	Maximum
TINYINT	1	–128 or 0	127 or 255
SMALLINT	2	-32,768	32,767
MEDIUMINT	3	–8,388,608	8,388,607
INTEGER	4	-2,147,483,648	2,147,483,647
BIGINT	8	-9,223,372,036,854,775,808 …	

https://dev.mysql.com/doc/refman/8.0/en/integer-types.html

Numeric Data Types

- **DECIMAL(precision[, scale])**
  - Precision: total number of digits
  - Scale: of total, how many are right of decimal
- **DECIMAL(3,2)**
  - 9.37 is okay
  - 12.42 will overflow
  - 0.567 will be rounded to 0.57

https://dev.mysql.com/doc/refman/8.0/en/fixed-point-types.html

Numeric Data Types

- **FLOAT, DOUBLE**
  - Considered “approximate” (rounding errors)
  - Behave the same
  - Differences are implementation-dependent
  - Used for really large or really small numbers
  - Compatible with scientific notation

https://dev.mysql.com/doc/refman/8.0/en/floating-point-types.html

Character Data Types

- **CHAR(width)**
  - Fixed width
  - Anything < width has trailing spaces
- **VARCHAR(maxwidth)**
  - Width can vary up to the maximum
  - More overhead (small) than CHAR( )

https://dev.mysql.com/doc/refman/8.0/en/char.html

Character Data Types

- **CLOB: Character Large Object**
  - For storing large text values
    - e.g. the source text of an article
  - Can't be indexed or sorted
- **BLOB: Binary Large Object**
  - For storing large binary values
    - e.g. images, files

https://dev.mysql.com/doc/refman/8.0/en/blob.html

Temporal Data Types

- **DATE, TIME, TIMESTAMP (Date & Time)**
  - Input Format
    - Depends on the database system
    - All support YYYY-MM-DD date input format
  - Storage format
  - Display format
    - i.e. what's returned in a query, e.g. MM/DD/YYYY

https://dev.mysql.com/doc/refman/8.0/en/date-and-time-types.html

Other Column Types

- **ENUM**
  - Enumeration of string values
  - Non-standard, defined in MySQL
    - e.g. ENUM(‘fruit’,’veggie’,’banana’)

https://dev.mysql.com/doc/refman/8.0/en/enum.html

Other Column Keywords

- **PRIMARY KEY**
  - Indicates column values are unique
  - Allows each row to be uniquely identified
- **AUTO_INCREMENT**
  - Defined in MySQL
  - Automatically increments value for each row
- **UNIQUE**
  - For non-key columns that have unique values

https://dev.mysql.com/doc/refman/8.0/en/create-table.html

Data Manipulation Language (DML)

- **Create/Manipulate Data**
  - e.g. operate on row in table
- **Major statements**
  - INSERT: Creates new row(s) in table
  - UPDATE: Update value in col in row(s) in table
  - DELETE: Removes rows from table
  - SELECT: Retrieve data from table

https://dev.mysql.com/doc/refman/8.0/en/sql-syntax-data-manipulation.html

Data Manipulation Language (DML)

- Format Example
  - `INSERT INTO tabname (column order) VALUES (column values);`
- Example Statement
  - `INSERT INTO students (name, degree) VALUES ('Yasmin', 'CS');`

https://dev.mysql.com/doc/refman/8.0/en/insert.html

SQL SELECT Statements

- Retrieve information from a database
- Common clauses:
  - SELECT
  - FROM
  - WHERE, GROUP BY, HAVING
  - ORDER BY

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